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UNITED STATES DEPARTMENT OF AGRICULTURE
Office of Director of Science and Education
Washington, D. C.

REPORT AND RECOMMENDATIONS OF THE
NATIONAL AGRICULTURAL RESEARCH ADVISORY COMMITTEE
REGARDING

PROBLEM AREAS NEEDING EMPHASIS IN THE FURTHER DEVELOPMENT

OF THE
AGRICULTURAL RESEARCH PROGRAM OF THE
UNITED STATES DEPARTMENT OF AGRICULTURE

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Developed and Adopted at the Meeting Held in Washington, D. C.

May 13-15, 1964

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All members of society benefit from the new knowledge developed by agricultural research. Contrary to the popular opinion that such research is for farmers, experience has demonstrated that consumers are the main beneficiaries. By using the findings of research the producers, processors, and distributors of agricultural products have developed unparalleled efficiency. The result is that no where else in the world do the people purchase their food, as we do, for less than one-fifth of their income. No where else do a people have such high quality food.

Despite the success of agriculture in achieving its major objective of supplying consumers with high quality products at reasonable cost, current problems require a strengthened research program. New knowledge can solve these problems. It can help us to better conserve and utilize our forest, soil, water, plant and animal resources and to protect these resources from fire, insects, diseases, weeds and other sources of damage. It can help us to find ways of economically producing, processing, and distributing higher quality products. It can lead to improved protection of consumer interests and enhancement of consumer satisfaction. Increased investments in agricultural research will result in a stronger nation and in better living for all its people.

June 1964

Membership of National Agricultural Research Advisory Committee

William Applebaum, Massachusetts	William G. Kubicek, Minnesota
Dolph Eriscoe, Jr., Texas	Lyman D. McKee, Wisconsin
Ralph Cole, Nebraska	D. F. McMillen, California
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The National Agricultural Research Advisory Committee reviewed the entire research program of the Department of Agriculture considering the seriousness of various problems faced by the producers, processors, distributors and consumers of agricultural products in relation to the current research resources devoted to the solution of these problems. It also considered some 500 specific recommendations made by the 11 commodity and functional advisory committees. Each of these committees had devoted a three to five day meeting during the past year to a careful study of the research program in its area and had made recommendations for the strengthening of research.

GENERAL RECOMMENDATIONS

1. Long Time Plan. New knowledge developed by agricultural research has given the American consumer high quality products at reasonable costs. Further progress is dependent upon a continued and accelerated program. Hundreds of areas in which further knowledge is needed have been identified. These should be incorporated into a comprehensive 5- or 10-year program of research. This program should provide the basis for the determination of manpower, facility and financial needs. It should anticipate completion of specific projects and how the new knowledge developed by them can be used by research workers in attacking problems still to be solved. Portions of such a program have been recently developed and published, including the 10-year program for Forestry research, Senate Document 34 on utilization research, and in Senate Document 35 on food and nutrition research. The planning already done is commended, but its value will be enhanced if it becomes a part of a broader and more comprehensive plan that includes consideration of the contribution which each of the many scientific disciplines can make the development of needed new knowledge. Any plan needs to be periodically reviewed and revised as new problems arise and as new knowledge is developed. However, both scientists and the public can understand the need for and probable outcomes of a coordinated research effort if such a plan is developed.

2. Balance in Research Program. The committee is pleased with the continuing and increased support of the agricultural research program in the areas of production and utilization of agricultural products. However, the committee is concerned over the relative lack of research support in the equally important areas of marketing, economics and human nutrition. Improved efficiencies in production and finding of new and improved uses for agricultural products must be supported by a balanced program of research to find the most economical means of producing these quality products, and how to operate efficiently in marketing channels at home and abroad. We produce enough to be the best fed nation in the world, but we have great need for research in human nutrition to improve the health of the infant, the teen-ager, the elderly and the impoverished.
3. Public Image of Agricultural Science and Education. There is need to develop an understanding among the people of the United States that agricultural research and education is not a program for farmers alone. It benefits every person. It has been important in bringing about a high standard of living for all. Improved farming, marketing, processing, and distribution benefit the consumer.

The American consumer purchases his food with only 19 percent of his income. Even though the quality and convenience has improved greatly over the years, this is three percent less than he was spending 25 years ago and eight percent less than 50 years ago. In many nations people spend more than 50 percent of their income for food. For this they get a minimal diet high in starchy foods. This is very different from the adequate and gastronomically attractive diet which we enjoy.

The importance of agricultural science and education should be emphasized. One of the most effective ways of indicating this importance is to change the position of Director of Science and Education to that of an Assistant Secretary of the United States Department of Agriculture. The National Agricultural Research Advisory Committee strongly urges this change.

4. Agricultural Chemicals and Pesticides. The production of the high quality, low cost food supply enjoyed by the American consumer would be impossible without the use of chemicals for the control of diseases, insects, weeds and for other purposes. While no loss of human life has been attributed to agricultural chemicals properly used, very little is known about their accumulation in soils, plants, and animals and the effects of such accumulation. There is urgent need for a "crash" program of agricultural research directed broadly to protection of consumers of agricultural products. Such protection needs to

be achieved without loss in product quality and without increasing the costs of production, processing and marketing. Non-agricultural research may identify sources of danger, but only agricultural research will find ways of producing food and protecting our resources without danger to human or animal life. There are many ways in which science can achieve these objectives. Increased emphasis is needed on research on nonchemical methods of pest control such as biological controls, attractants, repellants, sterilization techniques, and resistant crop varieties and animals. There is need to determine realistic tolerance levels of chemicals. "Zero" tolerance is dependent on the analytical technique used and is neither feasible nor realistic. While the costs of intensified effort in this area are high, relative to present expenditures, the importance of the objective justifies adequate funding of this effort.

5. Tobacco and Health. The Department is commended for its immediate action and response to the publication of the Surgeon General's Committee Report on Smoking and Health. The Department properly indicated its concern and interest in behalf of the consumers as well as the producers and handlers of an important agricultural commodity, as expressed by Dr. W. C. Brady, Director of Science and Education, in his statement before the Subcommittee on Tobacco of the House Committee on Agriculture on January 29, 1964. Furthermore, study has been given as to how the research program of the Department can be reoriented to study the relationship between smoking and health.

The committee strongly urges that additional funds be sought to adequately support an immediate intensification of tobacco research with emphasis on the development of production and processing techniques that will protect consumers. Funds should not be diverted from the existing important tobacco research program of the Department although some reorientation may be in order.

6. Response to Earlier Recommendations. The committee is pleased that progress is being made in effectuating recommendations which the committee has made in the past. These recommendations are reaffirmed with the hope that further progress will be made.

The emphasis on basic research is continuing. This is desirable in creating new knowledge for use by scientists engaged in applied research.

The plans for exchange of scientists between the Department and universities, additional opportunities in training and upgrading of personnel, and better support of scientists through additional facilities and equipment, all contribute to strengthening the competency and productivity of the present scientific staff as previously recommended by the committee.

The committee is pleased that plans are in process for a National Agricultural Library and recommends that the Department seek vigorously to obtain funds to commence construction as soon as possible.

Continuing progress is being made in relocation of scientists who do not have the advantage of being part of a scientific community and in location of new facilities at or near existing Department research units or at land grant universities where other scientists, libraries, and appropriate scientific atmosphere can contribute to better research. The committee hopes that this trend will continue.

The committee is pleased that sizeable amounts of monies are being made available for contracts and grants to research institutions outside the Department. This technique has been used very successfully by other Departments and agencies to obtain the services of highly competent scientists in universities and research institutions.

Both the Department inhouse and extramural effort in agricultural research can be strengthened through this technique. Recent project grants to the State Experiment Stations for research in reduction of the cost of production revealed outstanding ideas in many areas worthy of research support.

RECOMMENDATIONS FOR PROGRAM DEVELOPMENT

Man's natural rights include equal access to natural resources. His obligation in addition to enjoyment includes development, improvement, and unimpaired transmission of these resources to future generations. Of these natural resources soils, water, air, crops, forests and animals are of prime concern to agriculture. The interplay of these resources and the manipulation, understanding and application of natural laws governing them largely determine the adequacy with which man is fed, clothed, and housed. Individuals and organized government have a responsibility to increase knowledge of conservation and improvement of nature's gifts for the enjoyment and benefit of all. Organized research is one method of doing this and USDA uses this as one guideline in program development.

The NARAC commends the 11 commodity and functional committees for the detailed and critical review of the specific areas of work that make up the Department's program. In reviewing the total program NARAC did not attempt to evaluate the specific recommendations made by these committees. It did, however, review these recommendations in arriving at its conclusions regarding the broad problem areas that should receive attention in the development of the budget for the Fiscal Year which will begin July 1, 1965.

Special Problems. At this point in time, three problems seem worthy of special citation, and added emphasis needs to be placed on them because of potential public hazard and public benefit. They are (1) the tobacco problem, (2) pesticide and herbicide residue problems, and (3) cost of production in upland cotton. Possible injury to public health, coupled with economic losses to growers and revenue losses to Federal and local government are likely results if added knowledge is not obtained about tobacco problems and pesticide residues. Because of a Congressional directive and the novel approach of using research as a tool to reduce government costs in a support program for a basic commodity, the special cotton research program designed to reduce the cost of producing upland cotton in the United States is appealing. To the extent that adequate funds were not available to initiate adequate work in these areas, the committee recommends the submission of a request for supplemental appropriations so that work might be adequately funded immediately. Maximum flexibility in the use of contracts and grants is urged until satisfactory facilities can be constructed and staffed.

Research conducted by the two Marketing Research divisions of AMS deals with the measurement and protection of market quality and with means of increasing marketing efficiency. Such research is important in improving the marketing of agricultural products. The Secretary's proposal to transfer Marketing Research conducted by the Market Quality Research Division and the Transportation and Facilities Research Division from the Agricultural Marketing Service to the Agricultural Research Service is not opposed by the committee. It is concerned, however, that the advantages of close association of Marketing Research with the service and regulatory activities of AMS should be maintained and strengthened by such a transfer. The identity of research with an objective of improving the marketing process should not be lost. There will be a need for a continuing coordination with other research underway in ARS, ERS, and other research agencies. Liaison should also be maintained with the distribution industry to assure a program designed to meet industry needs and promote an effective dissemination of research results to those who can use them.

By selecting ten broad areas for special attention, NARAC does not imply that other areas of research are unimportant. Many specific problems not included in these ten headings are extremely serious and deserve more research resources than they are now receiving.

1. Soil and Water Management and Conservation. Soil and water are basic to all agricultural production. Guidance is needed in the use of these resources in such a way as will result in the most economical use and preservation of the supply of water and in conservation of the valuable soil resources.

With the rapidly increasing demands on the water supply, it is essential that ways may be found to increase the yield of usable water as well as to make more effective use of this resource. Studies

relating to ground water use and recharge, conserving and using the water resources of small watersheds, the storage and effective use of water over broad areas, and the prevention of water pollution, should have high priority in an expanded research program.

In expansion of soil research special attention should be given to such matters as drainage and salinity problems, soil-water-plant relationships, and the potential of minimum tillage operations under varying conditions.

2. Protection of Crops, Forests, and Their Products. Research in this area is customarily equated with increased production and, in the public mind, considered wholly for the benefit of the farmer. In fact, this is not at all true. Our competitive economic system in agriculture and the discriminating demands of the public for quality produce insure that research findings in this area accrue to the benefit of consumers. In addition to saving multiplied millions of dollars annually, adequate protection from insects, diseases, weeds, parasites, fires, etc., insure a more stable and wholesome supply of food, fiber and wood products to the consuming public. To minimize the possibility of public hazard to humans and wildlife, research to achieve protection should emphasize a massive, dynamic and aggressive biological and nonchemical control program; genetic development of resistant varieties and a full understanding of all aspects of insect life and diseases.

Control of damaging animals should be effected by increasing effort on use of repellants, systemics, use of vegetative cover and other means. Adequate inspection should be constantly maintained to prevent the inadvertent introduction of new and more destructive strains of diseases, insects, and pests from foreign nations.

3. Agricultural Chemicals and Related Residues. Regardless of current disfavor, the continued use of chemicals as pesticides, insecticides, herbicides, nematocides, parasiticides and drugs is essential for the foreseeable future, to efficient production, storage, and distribution of agricultural products. Intensification of effort on the function and fate of these chemicals together with development of new, safer, and more economical products is needed. The concept of "zero tolerance" is impractical for agriculture and a policy of "finite tolerance" should be instituted. Basic work on how chemicals might be metabolized and not leave toxic residues is desirable.

Studies of the disposition, persistency, translocation and decontamination of radioactive fallout which might occur in case of disaster should also be expanded.

4. Production of Livestock and Livestock Products. It is recognized that the sale of livestock and livestock products provide more than one-half of our cash farm income and provide one-third of the food energy and two-thirds of the protein in our total food supply.

Lessening of consumer interest in fats from animal sources indicates need for increased supply of lean meats, poultry and low fat dairy products. To be competitive these products must be produced in a more efficient manner.

Protection of livestock and their products from diseases, parasites, and insects and fallout residue can save the consuming public millions of dollars in increased production efficiency and product quality. Research effort at a high level is needed to achieve this protection, with emphasis placed, where possible, on biological and nonchemical control. Many livestock and poultry diseases currently cause large losses which justify an expanded research effort which will lead to their control or eradication.

The tendency to enlarge farm operations involving greater numbers of livestock in more concentrated areas indicates need for research on design of structures and equipment and new concepts in disposal of animal wastes and adequate water supplies. There is also a need for better methods of evaluating heritability, and detecting superior animal characteristics, and the preservation of semen from superior animals with improved feed conversion efficiency and carcass characteristics.

5. Economics of Production and Resource Development. The rapid technological change in agriculture results in increased efficiency and greater output from a given quantity of resources. The tendency for production to out-run market demand results in supply-price problems and forces continued economic adjustment in the farm economy.

There is need for an expanded program of economic research to guide producers in connection with their adjustment problems as well as to provide guidelines for persons responsible for developing broad agricultural policies. There is urgent need for objective studies of the economic consequences of alternative action programs both domestic and foreign. This includes the problem of economic development of low-income rural areas, solution of which would both improve the economic status of the people involved and avoid aggravation of the problem of urban unemployment.

The use of purchased inputs in agricultural production becomes increasingly important. This, together with increase in size of operating units, leads to ever-increasing capital and credit problems. Preservation of the family-type farm will require change from the traditional methods of providing capital. Research designed to provide guidance in this field should be given high priority.

6. Product Development and Processing. The research to develop new and improved products from agricultural commodities may be divided into basic work on chemical and physical properties, development of products for food and feed and development of industrial uses. The increasing attention to basic work is commended. The present balance between work to develop industrial uses and work to develop food and feed uses is well conceived. It is hoped that the considerable number of projects being carried out in foreign countries with P.L. 480 funds will be of substantial assistance in increasing export markets for U.S. farm products.

The committee noted the progress toward construction of additions at existing utilization laboratories and on the new Southeastern laboratory. These will provide the facilities needed for new work and increased effort on many pressing problems. Added funds must be provided in the future to adequately staff these laboratories with scientific and supporting personnel. This should be done without retrogression in the current level of work being carried out by contracts and grants.

Utilization research with its competence and record of success developing new knowledge in the chemistry and physical properties of natural products is in a unique position to make a major contribution to tobacco research. More knowledge in these areas has great potential as a contribution to the safety and welfare of consumers.

Continuation and expansion of an aggressive research and development program on wood and wood utilization is essential. Lumber use in construction has suffered at the expense of non-forest raw materials including metal, plastics and other synthetics. Additional research must be performed on stabilization, preservation, fire-proofing, wood-coating interaction and other problems if forest products are to continue to find substantial markets in construction.

7. Marketing Efficiency, and Economics. New and improved methods of identifying and measuring quality are needed to provide better grades and standards and more objective grading procedures. Better information on quality would be used by farmers, processors, marketing firms and consumers in producing, processing and selecting products to fit their needs. Additional research in handling, processing, storage, transportation and packaging of agricultural products can result in greater efficiency in the marketing and distribution of agricultural products, benefiting both the producer and consumer.

The President's recommendation that Congress establish a National Commission on Food Marketing to study the food industry from the farm to the consumer is evidence of widespread concern with this

subject. In view of this, it is difficult to understand why adequate appropriations have not been forthcoming to support research in the wholesaling and retailing of food and other research directed toward reducing the cost of marketing.

Such research is essential to all elements of the marketing system and many smaller distributing organizations are not in a position to provide it for their own guidance. Accordingly, it is viewed as most appropriate that it be carried out by USDA.

In this evolving era of mass distribution, it is especially important that the USDA concentrate studies in depth on the economics of marketing. Basic to such studies are adequate data and analysis.

8. Food Consumption. The proposed national food consumption survey (to be carried out on an individual as well as a household basis) is basic to an assessment of whether nutritional requirements of the public are being met. This survey should be undertaken without further delay. Information is also needed on food consumption in restaurants and food service institutions. Opportunities for new food uses may exist.
9. Export Markets and Foreign Economic Analysis. The explosive and fundamental changes occurring in recognized and potential export markets for U.S. agricultural products necessitate increased emphasis on foreign economic analysis. Basic to such research is the accumulation of economic facts relative to production and marketing of agricultural commodities throughout the major producing and consuming areas of the world. Closely related, is the study of the national farm policies of such countries.
10. Human Nutrition. Marked expansion of research on human requirements for nutrients and foods, and how best to meet these requirements, is essential to undergird the national program of food production, processing, marketing, and consumer education in nutrition and food use. The issuance of a revised handbook on composition of foods is noted with satisfaction.

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UNITED STATES DEPARTMENT OF AGRICULTURE
Research Program Development and Evaluation Staff
Washington, D. C.

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REPORT AND RECOMMENDATIONS OF THE
NATIONAL AGRICULTURAL RESEARCH ADVISORY COMMITTEE
REGARDING
PROBLEM AREAS NEEDING EMPHASIS IN THE FURTHER DEVELOPMENT
OF THE
AGRICULTURAL RESEARCH PROGRAM OF THE
UNITED STATES DEPARTMENT OF AGRICULTURE

Developed and Adopted at the Meeting Held in Washington, D. C.

April 29-30, 1965

Membership of National Agricultural Research Advisory Committee

G. C. Cortright, Mississippi
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H. Brooks James, North Carolina
Lyman D. McKee, Wisconsin
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N. C. Brady, Chairman
W. C. Dachtler, Executive Secretary

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The National Agricultural Research Advisory Committee reviewed the research program of the Department of Agriculture considering the seriousness of various problems faced by the producers, processors, distributors and consumers of agricultural products in relation to the current research resources devoted to the solution of these problems. It also considered specific recommendations made by the 13 commodity and functional advisory committees. Each of these committees had devoted a three to five day meeting during the past year to a study of the research program in its area and had made recommendations for the strengthening of research.

GENERAL RECOMMENDATIONS

Public Image of Agricultural Research. Agricultural research has made a substantial contribution to the ever improving standard of living available to us all. Newer and continuing developments leading to lower cost, and higher quality foods and fiber will come about as a result of a stronger research program supported by a sympathetic and understanding public.

To accomplish this objective, it is imperative that the image of, and an understanding of, the role of agricultural research be established in the mind of the general public. Regardless of our individual interests and our walk of life, we are all in a consumer category and agricultural research is of interest to us all.

Support for Agricultural Research. Increasing budgetary demands in other areas of activity of the Federal government, including special areas of research such as the space program, and the research program of HEW and NIH, together with the obvious desirability of attempting to achieve a balanced National budget, have created a serious problem of maintaining an adequate level of support for agricultural research. Funds for this purpose last year were only 187% above the 10 year previous level. In contrast, funds for all Federal research have increased from 3 to 17 billion dollars during this same period, an increase of 460%.

Agricultural research may truly be said to be the frontier of our National security and only an adequate far-reaching effort and emphasis on expanded research will continue to insure the ability of American agriculture to contribute so much to the blessings of abundance, the welfare of the Nation, and peace in the world. Never before, in the face of a burgeoning world population, has there been a greater need for answers to the many and continuing problems of producing an abundance of food and fiber for the needs of the people of the world.

Long-Range Planning and Objectives. The Committee is emphatic in its expression of the need for longer range planning and the establishment of broad objectives for agricultural research. It commends the start that has been made in four areas -- a program for soil and water research, outlined in Senate Document No. 59, 86th Congress; the 10-year National Forestry Research Program transmitted to the Congress in April 1964; food and nutrition research described in Senate Document No. 35, 88th Congress; and the utilization research program outlined in Senate Document No. 34, 85th Congress.

The Committee is disappointed, however, that full consideration was not given the 1961 plan for agricultural research and that its implementation was thus precluded. The Committee notes with approval that the Senate has recommended that a thorough review be made of agricultural research activities throughout the Nation. It is urged that a long-range plan be developed on the basis of this evaluation and that such a plan be

implemented in an orderly manner.

In the interim, it is hoped that the plans in the four areas referred to will be implemented and as the overall plan is developed, be integrated with it.

While stressing the importance of such coordinated planning, the Committee recognized the great complexity of the agricultural research effort of the Department, and while urging its coordination, stressed the importance of sufficient decentralization of the actual direction of research to permit encouragement of individual initiative and excellence.

The Committee believes that the choice of research objectives should be made a responsibility of administrators and staff as much as possible. Local demands and political consideration should not take precedence over sound administration of research. The executive and legislative branches of the Government should seek to adopt policies which will respect and insure and protect this basic policy.

Greater Emphasis on Basic Research. The Committee notes with approval the Department's continued emphasis on basic research, now representing 36% of the total effort, as contrasted with 26% five years ago, and approves of the ultimate goal of 50%. The logical and effective approach to the solution of practical problems lies in a reservoir of basic research which unlocks to man the secrets of the phenomena involved. The Committee particularly commends the continued development of pioneering laboratories where multiple disciplines may be brought to bear on the study of such phenomena.

Research Locations and Facilities. The Committee approves the general program of centralization of agricultural research in modern, well-integrated laboratories with complete library services and, where possible, in an academic surrounding. However, it wishes to call attention to the fact that there exist important problems where useful answers can be obtained only under field conditions.

The Committee notes with satisfaction the improvement in equipment and facilities in certain areas such as utilization and forestry, but feels concern that progress in some other areas is slower than is desirable. The current rate of construction is lagging behind that outlined in the National Forestry Program; the nutrition and food research laboratories at Beltsville are inadequately housed in three different buildings; and there are no facilities for human metabolic studies.

Cooperation and Coordination. The interrelationships among the research programs of USDA, State Experiment Stations and private industry present unique problems and opportunities in coordination among research men of various scientific disciplines. Sound channels of communication between the various agencies and groups involved in improving the production and marketability of American agricultural products from the initial stages of design and production to final consumer use and acceptance are

the ultimate objectives of proper cooperation and coordination.

Balance Among Phases of Program. Problems in agricultural research are constantly changing in relative importance necessitating a periodic review to maintain a proper balance. Two areas of research are of special concern to the Committee. It believes the current level of engineering research both on the part of the USDA and the State Experiment Stations is too low. Secondly, the shifting of the population of our Nation from rural to urban areas indicates a need for additional studies of the economic influence of this changing pattern on both rural and urban communities.

Environmental Pollution. The rapidly increasing population of the United States, together with the associated increasing problem of pollution of our air, water, and soil resources, requires a vastly increased level of research. The interrelationship is such that one or more pioneering laboratories should be established where all facets of the problem may be brought under concentrated study to arrive at corrective measures before major losses of human life and other economic assets of the Nation may otherwise have occurred.

Contracts and Grants. The Committee reiterates its views that additional consideration should be given by the Department to conducting a significant portion of its research responsibilities through the extensive use of grants as well as contracts, recognizing that this would require the appropriation of additional funds in most areas to avoid unwise curtailment of the present intramural and contract programs of the Department.

It suggests that optimum use of this approach would be facilitated by the establishment, within the Department, of an office, adequately staffed, whose sole responsibility would be the development of an optimum program of research conducted through grants, coordinated with the Department's own intramural and contract research programs. It emphasizes the desirability of the use of an advisory committee of consultant scientists from outside the Department in arriving at recommendations on the nature and extent of such a program as well as in the evaluation of specific research contracts and grants.

Assistant Secretary for Science and Education. The Committee believes that the prestige of research on agricultural problems could be materially enhanced by recognition accompanying an assistant secretaryship having responsibility in the area of science and education.

Support and Training of Scientific Personnel. The quality of research is largely dependent on the caliber of the scientific staff and the environment in which research work is done. Every effort must be made to upgrade the more promising professional scientists by encouraging them to enter in-service training, graduate training, and by approval of leave for further study. The need for scientists in presently existing or newly created areas of work continues to grow and these positions

must be made competitively attractive by providing adequate facilities, equipment and supporting personnel.

Dissemination of Results of Research. The prompt and effective dissemination of the results of research into the hands of potential users can be one of the most effective forces in utilization of new knowledge and information. The current methods of press releases, publications, and other practices should be evaluated. More effective use of radio and TV might be made. In addition, presentations to industry and trade meetings, wherever practical, by a staff person who has participated in the particular project, may well prove a most efficient and effective method.

RECOMMENDATIONS FOR PROGRAM DEVELOPMENT

Agricultural Chemicals and Related Residues. The Committee commends the Department for initiating and vigorously pursuing the greatly intensified program of research directed broadly to the use of agricultural chemicals and specifically to the study of the effect of chemical accumulations in the soil, plants and animals. For the foreseeable future, if the production, storage, and distribution of agricultural products is to be efficient, the continued use of chemicals as pesticides and drugs is essential. Attention should be directed to problems arising from the use of chemicals on forest lands as well as in other agricultural uses. The Committee believes that the concept of "zero tolerance" is impractical for agriculture and a policy of "finite tolerance" should be adopted.

Soil and Water Management and Conservation. The productivity of our soils and an optimum supply of good water are basic to agricultural and forest production. The Committee reemphasizes its previous recommendations that constant attention be directed to find ways of using these resources to conserve our valuable soil and reduce losses caused by wind and water erosion, from the loss of nutrients and organic matter by leaching, oxidation and crop removal, and as a result of tilth by compaction and salt accumulation. It is essential that ways also be found to preserve the supply of water and to make more effective use of this resource. High priority should be given to an expanded research program relating to ground water use and recharge, conservation and use of water resources of small watersheds, the storage and effective use of water over broad areas, and the prevention of water pollution.

Protection of Crops, Forests and Their Products. Although better protection of our Nation's biological resources related to crops, animals and forests necessarily leads to increased production, it also results in higher quality products. The Committee believes that much more emphasis needs to be focused on the benefits to the consuming public of research on the control of plant and animal diseases, parasites and pests. In the public mind these studies are most often considered as wholly for the farmer's benefit. Our competitive economic system and the discriminating demands of the public for quality products insure that research findings in this area accrue also to the benefit of consumers.

Adequate protection from insects, diseases, weeds, parasites, fires, etc., insure a more stable and wholesome supply of food, fiber and wood products. Research to achieve protection should emphasize a massive, dynamic and aggressive biological and nonchemical control program, genetic development of resistant varieties and a full understanding of all aspects of insect life and diseases. Control of damaging animals should be effected by increasing effort on the use of repellants, systemics, use of vegetative cover and other means. Adequate inspection should be maintained to prevent the inadvertant introduction of new and destructive strains of diseases, insects and pests from foreign nations.

Efficient Production of Quality Products. The farming industry, in order to make its full contribution to the health and welfare of our Nation, must attract and retain a high level of business and production competence. The Committee, therefore, strongly supports recommendations that research efforts be concentrated on the economics of commercial farming and increased emphasis be placed on agricultural engineering studies with the objective of achieving an agricultural industry that is more productive, efficient, and profitable and thus will attract and retain a high level of management and production skills.

The trend to larger farm operations involving greater numbers of live-stock in more concentrated areas indicates a need for research on design of structures and equipment; new concepts in disposal of animal wastes and provision for adequate water supplies; and facilities and methods which lead to more effective control of diseases of animals under more confined conditions.

The tendency for production to out-run market demand results in supply-price problems and forces continued economic adjustment in the farm economy. Economic research should be expanded to assist producers in solving their adjustment problems as well as to provide guidelines to persons responsible for the development of agricultural policies. There is urgent need for objective appraisal of the economic consequences of alternative action programs, both foreign and domestic, including the problems of economic development of low-income rural areas. The use of purchased inputs in agricultural production and the increase in size of operating units lead to intensified problems related to capital and credit. Research which may give guidance in this field should be given high priority.

Efficiency in Marketing. The efficient production of a high quality food and fiber supply for the American public is dependent upon the efficient operation of three groups of industries: first, those industries which provide the farmer with supplies and services; second, the farmers themselves must be efficient; and third, those industries which process, store, transport, handle and market both food and fiber must be efficient. If any one of the three groups fails, it impairs the competitive position for a commodity or group of commodities as well as increases the cost to the consumer. Marketing research in the USDA is designed to increase efficiency in the first and third groups and to

influence efficiency in the production of farm products (second group).

Not only is more research needed in marketing, but more attention should be given to the coordination of marketing and production research. In addition, special attention should be given to the coordination of technology and economics in marketing research. It is the application of both that results in increased efficiency.

Of particular importance to marketing research, at this time, is the need for more effort devoted to quality identification and measurement. Pricing efficiency and to some extent handling efficiency is dependent upon quality identification and measurement. Closely associated with this and of tremendous importance at this time is pesticide residue identification. Better information on quality would be used by farmers, processors, marketing firms and consumers in producing, processing and selecting products to fit their needs. Additional research in handling, processing, storage, transportation and packaging of agricultural products can result in greater efficiency, benefiting both the producer and the consumer.

Marketing research should be well enough financed so that it could deal with problems of National scope. Regional or local problems could be handled on a regional or State basis but should not be the primary goal of the USDA's marketing research program. However, it is recognized that in many cases regional or State research might become a part of a larger national research program.

Foreign markets for agricultural products are of tremendous importance to America, not only to farmers and those who handle farm products but to the entire economy because of the acute balance of payment-situation facing the Nation. The rapid and basic changes taking place in present and potential export markets for U. S. agricultural products require greater emphasis on foreign economic analyses which will accumulate information on the production and distribution of agricultural commodities throughout the major producing and consuming areas of the world.

Utilization (Improved Product and Process Development). Farm and forest products must ultimately be used by consumers, and the total use and dollar value of these products are obviously affected by the quality and price of competitive materials. The USDA is charged with the responsibility of assisting the maintenance and expansion of domestic and foreign markets; the Department's agricultural research must therefore continue to participate aggressively in the development of improved food, fiber and industrial products. No other organization is better qualified to carry out the basic research which is essential to product development based on agricultural raw materials, and it must be recognized that processing industries will tend to carry out basic research on nonfarm raw materials. The vital basic knowledge of chemical composition as well as of chemical and physical changes during growth, storage, and processing must be in reasonable balance with applied research and development to insure that the fundamental research is not

carried out in a vacuum. It is believed that such balance is presently being maintained in the Department's utilization research. However, additional information is needed in some areas and basic research should be expanded in several of these areas.

Broadly, research on food products should - in addition to increased basic studies on composition and compositional changes during processing -- continue to stress improvements in quality and processing techniques. The trend toward convenience foods must be considered in new food product development, with particular regard to compositional changes during processing.

Cotton, wool and leather all face serious competitive threats from synthetic materials and increased basic and applied research effort is necessary to maintain both consumption and value of these farm products.

Industrial products based on such agricultural raw material as animal fats and oilseeds are also meeting competitive pressures from synthetics, such as latices and plasticizers. Expanded basic research on composition and possible chemical modifications especially are needed.

Expansion of research and development also is essential on the utilization of wood and wood byproducts since their use in construction must now compete with plastics, glass, metal and other products. New market outlets for wood of all grades are required to maintain a healthy timber growing industry.

The Committee supports the current emphasis on tobacco research with particular reference to compositional studies on tobacco leaf and smoke, and to changes which may be related to aging and processing.

In view of its potential in both human and animal nutrition, the Committee feels that additional applied research and engineering development should be directed toward low-gossypol and gossypol-free cottonseed meal or flour.

Expanded research in areas such as pharmacology and toxicology should be carried out in support of and as a closely related element of specific utilization programs such as pesticide use, for example.

Nutrition and Consumer Use. The Committee views as major national problems in human nutrition the lack of knowledge of the nutrient content of foods as currently consumed in the United States and of adequate data on which to base estimates of human requirements for these nutrients in order to obtain optimum health. These are traditional areas of Department research responsibility and are only marginally pursued or supported by other Government agencies. There is insufficient support for research in the United States on natural toxic substances in foods, the potential of some newer processing techniques to result in the development of toxic substances, and the growing possibility of toxic intentional and non-intentional additives to foods despite the

increasing availability of sophisticated techniques for studying these problems. The related work of the Food and Drug Administration is not a substitute for active research on food toxicology within the Department of Agriculture.

Another area of special responsibility of the Department is that of food consumption and diet appraisal. The periodic determination of national food composition trends needs to be supplemented by more continuous involvement of the Department in studies of the dietary habits and food use of special population groups or selected commodities.

The Committee believes the Department should seek modification of its legal authority for nutrition and consumer use research to remove any limitation of its efforts to the needs of only the rural population. It recommends a new facility in the Washington metropolitan area to house all USDA nutrition and consumer use research and that the three regional laboratories proposed in Senate Document No. 35 be delayed until personnel are available to staff them. The Department should implement a grant program to supplement its nutritional and consumer use research. Continuation and extension of nutrition and food research projects in foreign countries under P.L. 480 also is endorsed by the Committee.

The Committee supports the Department's proposal to obtain the services of a physician with extensive training and experience in human nutrition to direct intramural research dealing with the food utilization and nutrient requirements of normal human subjects. It stresses, however, that such a program must be supplemented by extensive grant and contract support of this particular type of work in order to achieve satisfactory progress in obtaining the required information. Studies to-date have involved largely young adults although some important work on adolescents and elderly persons has been supported. The need for data on all age groups and physiological states indicates the magnitude of the task ahead.

Research on the composition of foods, the nutritional effects of processing and storage and their nutritive value and toxicity in biological tests in experimental animals and man is seriously under-supported in the United States. This is due largely to the fact that in this area of its traditional responsibility, the Department program has been weak and no other Federal agency has sufficiently taken on this responsibility. The need can be met only by strengthening the intramural program in this area and very much expanding the extramural program through both grants and contracts.

The Committee is gratified that plans for the 1965 National Food Consumption Survey are well advanced and believes that the need for special purpose surveys justifies a continuing research effort at this level of expenditure.

The Committee agrees with the low priority recently assigned to the work on clothing and housing. Family economic studies, however, have continuing importance particularly for low income and aged families. Their extension in number and depth should contribute to sound advice on the wise distribution and use of family income for food and other essentials.

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UNITED STATES DEPARTMENT OF AGRICULTURE
Research Program Development and Evaluation Staff
Washington, D. C.

REPORT AND RECOMMENDATIONS OF THE
NATIONAL AGRICULTURAL RESEARCH ADVISORY COMMITTEE

Developed and Adopted at the Meeting Held in Washington, D. C.
August 24-26, 1966

Membership of National Agricultural Research Advisory Committee

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The National Agricultural Research Advisory Committee reviewed the agricultural research program considering the seriousness of various problems faced by the producers, processors, distributors and consumers of agricultural products in relation to the current research resources devoted to the solution of these problems. It also considered specific recommendations made by the Research and Marketing Act commodity and functional research advisory committees. Each of the RMA committees had devoted a three-to five-day meeting during the past year to a study of the research program in its area and had made recommendations for the strengthening of research.

RECOMMENDATIONS AND COMMENTS RELATING TO THE
ADMINISTRATION OF RESEARCH

Support for Agricultural Research. It is essential that greater emphasis be given to agricultural research. The Committee believes there are several reasons at this time of special importance:

1. Research is needed to meet the problems associated with supplying the increased demand for food and fiber both at home and abroad. Population expansion and the need to raise the level of the nutrition and living standards require that many answers be found through research if we are to achieve the goals enunciated in the Great Society and Food for Freedom programs.
2. Many efficient agricultural enterprises do not now provide the return to labor, capital and management that these same resources can earn in alternative uses. As these inputs are forced to compete with alternative uses, it becomes apparent that either production will decline or the cost to the consumer will increase. Research can provide answers that will help maintain an adequate supply of high quality food and fiber at prices favorable to the consumer.
3. Publicly supported research must undertake those problems relative to the National interest for which the private sector of the economy has little incentive for finding solutions. These include the conservation of natural resources, disposal of waste material and the like.

Long Range Planning of Research. The Committee compliments and commends the States and the Department for the excellent study and analysis included in the Long Range Study of Agricultural Research. Adherence to the principles developed should improve greatly the results obtained from the research effort. It is important that provision be made for State and Federal cooperation and coordination in planning, budgeting and conducting research. The Committee cautions, however, that the long range plan should be sufficiently flexible in both budget and personnel to cope with important problems that may arise because of changes in the economy or scientific developments. The Committee again wishes to emphasize the continuing need for basic research and feels that expenditures of one-third to one-half of the total research budget are not too high.

The report prepared for the Committee summarizing the recommendations of the Research and Marketing Act Advisory Committees provides an excellent description of trends and depicts phases of research that need particular emphasis at this time. Many of these are mentioned under the sections which follow dealing with specific phases of research in the Committee's report.

With the Long Range Study as a guide, it becomes apparent that the immediate problem is one of implementation. The Committee concurs in the recommendation of the Agricultural Research Planning Committee that studies be made in depth of the most urgent problem areas on which research may assist in providing solutions.

Cooperation and Coordination. The interrelationships among the research programs of USDA, State Experiment Stations and private industry present unique problems and opportunities in coordination among research men of various scientific disciplines. Sound channels of communication between the various agencies and groups involved in improving the production and marketability of American agricultural products from the initial stages of design and production to final consumer use and acceptance are the ultimate objectives of proper cooperation and coordination.

The Committee recommends that the Department look for and develop additional ways in which the USDA, State and industry can bring their combined resources to bear on finding solutions to problems of broad significance.

Program Planning and Budgeting System. The Committee supports the Government-wide program to establish a uniform system of program planning and budgeting. It clearly recognizes the need for fiscal responsibility in all Departments of the Federal government. While it feels that the dollar expenditures for agricultural research are small indeed when compared with many other projects, it believes that each and every branch of government must be encouraged to regularly and systematically inspect itself closely to determine if any costs can be reduced. Research investigations underway or proposed for initiation should be examined along with all other program plans to determine if they may better be carried out and funded by private industry or cooperative organizations. The chances of prompt implementation of research findings are much greater when there is an industry input. This is especially applicable in the case of marketing research.

Current Research Information System. Recent efforts by the Department and other agencies of the government to establish an effective system for inventorying and the retrieval of research information are strongly endorsed by the Committee. The ready availability of such data on a current basis would be of substantial benefit not only to research staffs but to industry as well. The Committee believes close cooperation in the development and maintenance of the system by pertinent agencies such as NASA, DOD, AEC and SIE with SAES and USDA is essential. The National Agricultural Library should assume the responsibility for those phases of the system's operation relating to agriculture once it is developed.

Research Organization. The advantages of a centralized command structure for Federal research, as recently proposed, are far outweighed by the disadvantages, the Committee believes. Research activities should not be forced to conform to the rigid regimentation associated with such an organizational pattern. A wide latitude for the scientist is essential to imaginative and creative work.

The Committee favors the pluralistic structure used by the Department as a more workable arrangement. However, it firmly believes that there must be an efficient overall group, similar to the present Research Program Development and Evaluation Staff, to effectually coordinate the activities within the six USDA research agencies and to work closely with the SAES and other research organizations in the planning and evaluation of a National program of agricultural research.

Such a group could be of considerable assistance in achieving maximum results by the application of sound business principles which require that:

1. There be a clear statement of purpose. (Why)
2. There be a stated, defined goal that, if attained, would achieve the purpose. (What and When)
3. There be measurable results that indicate the degree to which the goal is being achieved. (How much)

The Long Range Study provides a major step in this direction and can serve as a guide, if properly implemented, in the application of these principles. There still seems to be a lack of fully effective application of sound business management principles as applied to the operation of the various research agencies judged by the manner in which the work was reported to the Committee.

Contracts and Grants. The Committee reaffirms its recommendation of the past several years that additional consideration be given to conducting a significant portion of its research responsibilities through the use of contracts and grants. It is aware that such expansion would require additional appropriations in most areas to avoid unwise curtailment of the present research programs of the Department. The Committee favors the use of contracts and grants to build centers of excellence and to strengthen underdeveloped institutions. However, it firmly believes that these increases should not be at the expense of the present institutional grant program (Formula or Hatch Act Funds).

Research Conducted in Foreign Countries with P.L. 480 Funds. The Department is commended for its effective use of counterpart funds to expand basic research on agricultural problems. By this means, the efforts of outstanding scientists in many countries have been enlisted in agricultural research of mutual benefit and need. Potential hazards to American agriculture have been studied at their source. A wealth of new knowledge has been obtained which holds promise of making important contributions to world food programs designed to alleviate protein and calorie deficiencies of the developing countries.

The Committee believes that it is time to give serious consideration to relaxing limitations on the use of P.L. 480 funds for research. We cannot hope to continue indefinitely to supply the world's needs for food and

fiber from our own capacity to produce. To achieve the goals and programs set forth by the Food for Freedom legislation now before the Congress, the Committee believes adaptive research will be required to build the capacity for indigenous production in the presently underdeveloped countries.

Scientific Personnel. The Committee fully agrees with the recommendations of the thirteen RMA Advisory Committees that a continuing effort must be made to attract, keep, train and recognize research scientists with unusual ability. It also is aware of the considerable progress which has been made in recent years in providing opportunities for retraining the scientists engaged in research. Certainly recognition, salary scale, and promotional policy all have a bearing on how well the USDA will be able to compete for and retain the capable people required to do the imaginative work necessary. The Committee believes more attention should be given to developing team efforts that signify a winning spirit, create an air of urgency and greater opportunity for scientists to work on controversial ideas which provide a challenge.

The Committee also commends the Department for the considerable progress made in establishing pioneering laboratories. Freedom for the scientist to pursue promising leads may well produce the new knowledge needed as a basis for the solution of many problems facing agriculture.

Assistant Secretary for Science and Education. The Committee reaffirms its previous recommendation that the prestige of research on agricultural problems could be enhanced by the recognition accompanying an assistant secretaryship having responsibility in the area of science and education.

Public Image of Agriculture. The Committee commends the Secretary of Agriculture and the Department for its increased attention to improving the public image of agriculture. This must be a continuing effort if we are to develop an understanding among the people of the United States that the Department's programs, especially its research program, are not of benefit to the farmer alone. Every citizen shares as a result of improvements in farming, marketing, processing, and distribution. The importance of agricultural science, education and research should be emphasized.

The Committee believes that the public image can be further improved by giving more attention to the following:

1. Careful review of programs of work to make them more creative and productive.
2. Improved methods of reporting research activities, emphasizing benefits to be derived, clearly defining purposes and definitively stating goals to be achieved.
3. Maintaining contact with past members of advisory committees to provide information on new developments which they could share with others and perhaps developing a procedure for polling past members for their views and counsel on important issues.

4. Create an advisory committee with a membership made up of people from industry who understand what is needed to build good public relations.
5. Develop better methods of reporting progress of research to the public through public sessions, State meetings, etc.
6. Present material in a meaningful and interesting manner by speakers who are both knowledgeable and dynamic.

RECOMMENDATIONS AND COMMENTS FOR PROGRAM DEVELOPMENT

Conservation, Development and Use of Soil, Water, Forest and Related Resources. Man's natural rights include equal access to natural resources. His obligation in addition to enjoyment includes development, improvement, and unimpaired transmission of these resources to future generations. Of these natural resources soils, water, air, crops, forests, and animals are of prime concern to agriculture. The interplay of these resources and the manipulation, understanding and application of natural laws governing them largely determine the adequacy with which man is fed, clothed and housed. Individuals and organized government have a responsibility to increase knowledge of conservation and improvement of nature's gifts for the enjoyment and benefit of all. Organized research is one method of doing this.

The Committee is pleased with the sizeable research effort underway by the Department and the States and the continuing emphasis planned for this area of work. It recommends, however, further intensification of research to solve problems of subirrigation and reassessment of that phase of the 10-year projections involved with the level of work in forest management.

Protection of Man, Plants and Animals. Research in this area customarily is equated with increased production and, in the public mind, considered as wholly for the benefit of the farmer. In fact, however, this is not true. Our competitive economic system in agriculture and the discriminating demands of the public for quality produce insure that research findings accrue to the benefit of consumers. In addition to saving millions of dollars annually, adequate protection from insects, diseases, weeds, parasites, fires, etc., insure a more stable and wholesome supply of food, fiber, and forest products to the consuming public.

Border plant quarantines have been effective in preventing the introduction of numerous plant pests into the United States. However, from time to time destructive plant pathogens have been introduced despite all precautions taken. It is urged that a laboratory be established at some isolated, off-shore location where potentially destructive plant pests not now present in the United States can be studied.

As research advances into highly promising new approaches to insect control, the need for research in isolated areas on total population of insects becomes more and more apparent. Because of the extensive movement of most insect species, it is virtually impossible to appraise the impact of various control methods on small segments of insect populations as is currently attempted. The Committee believes that research on the ecology, behavior, and control of total insect populations can best be carried out on isolated islands.

The Committee recommends increased effort to determine the fate of chemical residues including various forms of nitrogen applied to the soil. Careful consideration also should be given to studies of molds in crops including methods for their identification and measurement as well as the development of techniques for control.

Changes in the production and feeding of livestock, particularly the trend toward concentration, has intensified problems of animal health. One current example is the incidence of bluetongue. The Committee recommends an immediate increase in research on animal diseases.

We recommend intensifying all phases of research in waste disposal including the utilization of waste from farms, forests and agri-business.

Efficient Production and Quality Improvement. The farming industry, in order to make its full contribution to the health and welfare of our nation, must attract and retain a high level of business and production competence. The Committee, therefore, strongly reaffirms its previous recommendations that research efforts be concentrated on the economics of commercial farming and that increased emphasis be placed on agricultural engineering studies with the objective of achieving an agricultural industry that is more productive, efficient, and profitable and thus will attract and retain a high level of management and production skills.

It is very important that research be undertaken to provide leadership in the selection, training, management and compensation (including incentives) of farm labor. The Committee suggests in addition that consideration be given to the use of industrial psychologists in studies of the budgeting of farm enterprises.

It also is apparent that one of the road blocks to carrying out agricultural engineering research is the lack of both the number of qualified agricultural engineers available and the opportunities for retraining present agricultural engineers to meet current requirements in this field. The Committee recommends that a very high priority be given to this problem.

The Committee recommends that a completely new look be taken at forage harvesting, transportation, storage and feeding, to achieve significantly improved efficiencies in handling and digestibility.

The mechanization of milking is seriously lagging as compared to other areas. To attract and pay labor of a proper quality, increased

production of milk per man-hour is essential. One possible approach is that of the assembly line principle now being tested in California.

It is important to determine the effect of controlled environment on the efficiency of gains of livestock and the production of eggs and poultry meat. We recommend enlarging the research effort on controlled environmental studies of livestock and poultry.

Work on the mechanization of pulp wood harvesting also should be accelerated. Agricultural engineering schools, particularly in the Southeastern states, should give more attention to this problem.

The Committee recommends increased emphasis in research on breeding of horticultural crops to achieve improved flavor and other quality factors. New procedures for preserving the quality of horticultural products during shipment and on the shelf in stores also should be evaluated carefully.

Application of Remote Sensing Techniques to Agriculture. The Committee is favorably impressed with the initial efforts of the Department, in cooperation with other agencies, to adopt space technology to agricultural problems. Speed in identifying outbreaks of plant pests is of paramount importance. The use of remote sensing from suborbital aircraft appears to have promise of being most immediately effective. The Committee strongly recommends intensification of research in the application of remote sensing techniques to more quickly identify and measure land use, detect the incidence of plant diseases, insect infestations and drought, assess crop stands and vigor, and to determine soil conditions. The Committee believes that the substantially increased resources which will be required to achieve a goal of this magnitude should be vigorously sought.

Product Development and Processing. The Department has the responsibility of assisting in the maintenance and expansion of both domestic and foreign markets. It, therefore, must continue to participate aggressively in the development of improved food and fiber products. While the processing industries carry out research to apply basic knowledge to the improvement of products and processes, the Department must supply much of the foundation through direction of its program toward obtaining more knowledge of the chemical constituents, physical properties, and microscopic structure of agricultural commodities.

Emphasis should be given to (a) identification and objective measurements of odor and flavor and methods for their improvement; (b) measurements of pesticides, residues, and other contaminants of food and feed and establishment of reasonable tolerances where necessary, (study methods of removal of contaminants); (c) increasing the effort on the mode of action of mycotoxins in grains and seeds; (d) providing better methods of detection of toxic factors, natural and applied; and establishing adequate small animal facilities for preliminary screening of toxicity of new products; (e) expanding basic studies on microbial enzyme systems; (f) studying protein isolates and concentrates from grains, feeds and oilseeds; (g) increasing research on control of pollution and more effective waste

disposal with particular emphasis on these factors in the development of new processes.

It is the feeling of the Committee that so long as the present trend in population and costs continues, emphasis in utilization research should be directed more toward food uses than toward industrial utilization. Such a change should necessarily be gradual and tempered in order to maintain a sensible balance between these two directions of research. Particular attention should be devoted to development of food products that would be acceptable in developing countries using our basic crops and including, where possible, foods indigenous or adapted to these countries.

Utilization research on horticultural crops should give high priority to the biosynthesis of flavors in fruits and vegetables. Further exploration also is much needed of methods to dry and treat vegetables and fruits in order to reduce storage costs and improve consumer acceptability. This will involve more effort on studies of irradiation, freeze-drying, canning, puff drying, etc. and the determination of the effect of these processes on flavor, odor and palatability.

In research on field crops priority should be given to the development of better knowledge of the quality and availability of proteins of cereal grains and forages and their economic conversion into acceptable foods and expansion of studies of grains and oilseeds to include protein/lipid and protein/carbohydrate interactions in this conversion. Work on the storage of grains, oilseeds and other field crops has been good but there is need for continuing attention on treatments and storage conditions that minimize insect or mold contamination.

Improvement of Human Nutrition and Consumer Satisfaction. Knowledge of human requirements for nutrients and food and how best to meet these requirements is essential to undergird the National program of food production, processing, marketing and consumer education in nutrition and food use as well as to adequately meet the goals set forth in the Food for Freedom program. The Committee recommends high priority be given to the planning and construction of a central facility for research in human nutrition.

Particular emphasis is recommended for research to study metabolic differences of various carbohydrates and the value of cereal proteins in the diet. More attention should be given to dietary appraisal, especially the food consumption patterns and nutritional evaluation of preschool children and the aged. The effect of food distribution programs on the diet and welfare of needy families should be analyzed. Increased attention also should be given to composition and nutritional value of foods in relation to their processing, storage and cooking.

Studies of body measurements should be extended to include the elderly and to update measurements of children.

Efficiency in Marketing. The efficient production of a high quality food and fiber supply for the American public and for export is dependent upon the efficient operation of three groups of industries: first, those industries which provide the farmer with supplies and services; second, the farmers themselves; and third, those industries which process, store, transport, handle and market food. If any one of the three groups fails, it impairs the competitive position for a commodity or group of commodities as well as increases the cost to the consumer. Marketing research in the USDA is designed to increase efficiency in the first and third groups and to influence efficiency in the production of farm products (second group).

Not only is more research needed in marketing, but more attention should be given to the coordination of marketing and production research. In addition, special attention should be given to the coordination of technology and economics in marketing research. It is the application of both that results in increased efficiency.

The National Commission's Report on Food Marketing should be used as a basis for determining the needs for additional research to complete a description of the national marketing structure and to make provisions for a continual process of updating the analysis of the National marketing system. The rapidity with which changes take place in the Nation's food marketing system makes it increasingly important for marketing researchers to keep their analysis abreast of the changes taking place. Changing demand patterns, preferences, and the need for more information in regard to what constitutes an adequate stock of food in the United States should receive additional study.

Of particular importance to marketing research is the need for more effort devoted to quality identification and measurement. Pricing efficiency and to some extent handling efficiency is dependent upon quality identification and measurement. Better information on quality would be used by farmers, processors, marketing firms and consumers in producing, processing and selecting products to fit their needs. Additional research in handling, processing, storage, transportation and packaging of agricultural products can result in greater efficiency, benefiting both the producer and the consumer.

Marketing research should be well enough financed so that it could deal with problems of national scope. Regional or local problems could be handled on a regional or State basis and should not be the primary goal of the USDA's marketing research program. However, it is recognized that in many cases regional or State research might become a part of a larger National research program.

Foreign markets for agricultural products are of tremendous importance to America, not only to farmers and those who handle farm products but to the entire economy because of the acute balance of payment-situation facing the Nation. The rapid and basic changes taking place in present and potential export markets for U.S. agricultural products require greater

emphasis on foreign economic analyses which will accumulate information on the production and distribution of agricultural commodities through the major producing and consuming areas of the world and the necessary changes or developments in products which will increase foreign demand. The idea of establishing a laboratory in Europe to test the quality of food products on arrival is excellent and should be implemented on a reasonable basis.

Development of Human Resources. Research should emphasize the role that training and retraining can play in the development of productive citizens out of the people caught in the poverty cycle. It should be designed so as to provide the basis for action programs developed to alleviate poverty.

Evaluation of Public Programs, Policies, and Services. Research dealing with public programs should be developed to provide a guide for evaluating present programs and to serve as a basis for developing new programs. Such programs could deal with cost-benefit ratios, food reserves needed to service specific domestic and foreign programs, and the effect of foreign food programs upon balance of payments.



